AD-A157 749 EXPERIMENTS TO CORRECT A DIGITAL DATA BASE USING SCENE ANALYSIS(U) INSTITUTE FOR IMAGE PROCESSING COMPUTER MAPPING GRAZ (AUSTRIA) H RANZINGER 1983 R/D-4161-R-EN

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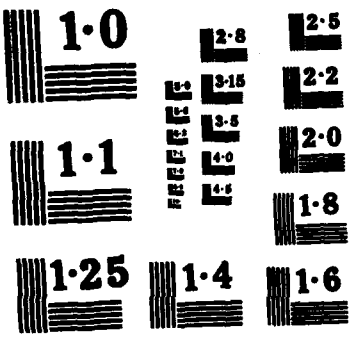

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(1)

EXPERIMENTS TO CORRECT A DIGITAL DATA BASE USING SCENE ANALYSIS

Principal Investigator

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Contract Number DAJA 45-83-C-0022

Contractor

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Sixth Progress Report Covering the contract period from 1 January 1985 - 30 June 1985

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1. Scientific Work Done During the Reporting Period

(a) A research strategy for automated screening of mapping and reconnaissance imagery based on map-guided scene analysis has been formulated based on the artificial intelligence concept of generate-and-test. Given explicit terrain data encoded in a digital map, procedures operating on a set of knowledge representations seek to predict what terrain components might be contained within each specified map catagory, the potential state(s) of each terrain component and plausible feature space values corresponding to such terrestial patterns based on spatial and radiometric characteristics of the sensor. A frame system serves to store the diverse map, terrain and sensor knowledge in a consistant and coherent manner.

Although the initial knowledge base will be relatively sparse, the approach appears to be sufficiently general to permit extensions to handle imagery from many types sensors and various feature extraction techniques including both space and frequency domain sampling. For experimental purposes, both metric photography and synthetic aperture radar (SAR) imagery from airborne and spaceborne platforms will be utilized.

(b) To support this map-guided scene analysis research, software modules have been developed to perform the following tasks: convert two-dimensional (2d) planimetric data to three-dimensional (3d) planimetric data using elevation values interpolated from digital elevation models (DEM); and map-to-image correspondence modules have been implemented in Common Lisp for metric (central perspective) cameras based on the collinearity condition and SAR systems based on the radar imaging conditions. Conventions have been defined for digital imagery to permit the use of interior orientation procedures embedded in the CRISP photogrammetric software system and the SMART radargrammetric software system. Further, interior orientation modules have been extracted from the CRISP system to support reconfiguration in special purpose systems. As a high precision alternative to planimetric augmentation, direct capture of 3d planimetric data from stereo aerial photography has been demonstrated using the DSR-1 analytical plotter with CRISP software as a stereo digitizer.

A simple frame system for flexible, diverse knowledge representation has been implemented in Common Lisp featuring capabilities for storing explicit object values as well as default values,

inheritance, procedural attachment and demons. A sophisticated, interactive statistical pattern recognition system, ISPAHAN, has been installed here to support low-level signal-to-symbol conversion.

(c) A series of autonomous screening experiments have been defined. Given existing digital map data for areal features representing landcover and a more recent image, the objective is to detect anomalous areas where the image data is inconsistant with the map. We consider this to be the baseline image screening task and will process a variety of optical and radar imagery to test the generality of our knowledge representation and generate-and-test approach. A set of conventional aerial photo transparencies was furnished to ETL for frequency domain sampling using the Recording Optical Spectrum Analyzer (ROSA). The resulting optical power spectrum (OPS) data were received here and decoded on our system for use with ISPAHAN. Unfortunately, anomalies in the OPS data which appear to be due to instrumental sampling deficiencies are apparent in the data. In the absense of improved OPS data, the experimental program has been recasted to emphasize processing of a broader suite of digital imagery than initially envisioned.

(d) An experimental data set has been assembled for a testsite west of Freiburg, West Germany.

Three-dimensional digital map is being assembled by planimetric augmentation of landcover, landform and lines-on-communication data digitized from German 1:50,000 topographic maps using the DESBOD software system.

A digital elevation model (DEM) compiled to a 20 meter grid and digital SAR and aerial photo data (scale 1:18,000) from the 1981 SAR580 Campaign were available from the earlier efforts of the International Society of Photogrammetry and Remote Sensing.

Additional aerial photography providing partial coverage of the test site in 1971 (1:10,500) and 1976 (1:21,000) has been furnished by the University of Freiburg. In 1983, the Spacelab Metric Camera imaged the test area but our site was obscured by cloud cover. Several space images from the NASA Large Format Camera (LFC) imaged the area in 1984 and have been ordered through USGS as co-investigator in the LFC program.

Additional SAR coverage of the site was obtained during the SAR580 Campaign (1981), by the Shuttle Image Radar (SIR-B) in 1984 and the airborne STAR-1 system operated by INTERA, Inc. of Canada; access to this imagery has been formally requested in each case.

2. Research Plans

(a) The frame system with photogrammetric and radargrammetric procedural modules for map-to-image correspondence will be integrated with digital map and image data in a digital image processing environment providing interactive display of the data and autonomous screening results.

(b) (b) Expansion of the digital image data set will continue. In addition to the digital SAR data which has been requested, analog photography such as the LFC imagery will be digitized using a flatbed microdensitometer to ensure photometric and geometry fidelity.

(c) Map-guided scene analysis experiments for autonomous screening of metric photo and SAR imagery will be conducted on as many images as time and available resources permit. Results will be evaluated in terms of digital map data validation and change detection.

(d) Copies of the research code, digital map and digital image data will be furnished to ETL.

(e) A Final Technical Report will be prepared.

3. Significant Administrative Action

None.

4. Other Information

G. E. Lukes participated in the First Scandinavian Research Conference in Linkoeping, Sweden as a member of a panel entitled "Knowledge-Based Geographic Information Systems". He also made an invited presentation on digital mapping to the military workshop held in conjunction with this conference at the Swedish National Defence Research Institute.

5. Financial Statement

This statement gives an accounting of amounts spent for the extension of the contract only.

Personnel - Salaries and Wages

Principal Investigator	$ 1.200.-
Software Support by Research Associate	$ 2.000.-
Data Acquisition by Technician	$ 800.-
	$ 4.000.-
Overhead-Institute 10 %	$ 400.-
Overhead-Central Administration 10%	$ 400.-
Expendable Supplies	$ 500.-
Computer Resources (250 hours at $25)	$ 6.250.-
Travel Expenses and Communications	$ 2.000.-
Total Amount Spent	$ 13.550.-
Amount Received ** none **	

$ 12.000.- partial payment is due with this report

6. Important Reports Acquired

None.

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